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ABSTRACT

This paper discusses the lessons learned from the use of early state-of-the-art Computer-Based Training (CBT) applications and hopes for the future. The paper is based on experiences with large introductory personal computer applications classes with over 700 students that used CBT such as Virtual Tutor and PinPoint. Findings are presented related to student evaluation of the CBT system, including student opinions of PinPoint, the class World Wide Web page, the textbook, and how much was accomplished in the course, as well as whether more assistance from the instructors was required and whether they would like to learn more about programming and/or using software applications. The following conclusions reported by instructors are also presented: (1) the interaction with PinPoint proved to contribute to successful learning; (2) CBT can be used effectively in small or large classes if it is customizable; (3) CBT eases students' inhibitions about using and learning technology; and (4) CBT can be an efficient learning tool in a classroom without taking away the vital importance of the instructor. (Contains 10 references.) (MES)

CBT: The Past, Present and, Hopefully, the Future

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Abstract: Computers are established today as a part of our day to day life. They are no longer just a professional tool but rather a commodity that helps people to work, communicate, shop or trade on line and at last, but not least, to improve the educational process. In this paper, we will discuss the lessons learned from our use of early state of the art Computer-Base Training (CBT) applications and what we hope to see in the future. Our presentation is based on the experience of the first author with large classes with over 700 students that used CBT like Virtual Tutor and PinPoint. Although our experiences are tied to specific tools, the lessons learned can be applied to a wide variety of similar tools. Actually, these tools tend to be more similar than not, which is rather disappointing considering there is not one approved way of "doing it right."

Introduction

Computers are established today as a part of our day to day life. They are no longer just a professional tool but rather a commodity that helps people to work, communicate, shop or trade on line and at last, but not least, to improve the educational process

The easy access to computers suggested the obvious educational application: automated training and testing. This technology-driven approach to computer supported training resulted in some early products that were not based on pedagogical theories (Docent, 1998), (VirtualTutor, 1999). The results were, not very surprisingly, rather disappointing. The situation has been gradually improving since then, yet there is still a long way to go.

Given the continuos increase in demand and the high level of expectations in the educational sector of our society regarding the educational potential of CBT applications, more and more companies are venturing into designing and implementing these type of applications. Actually, these tools tend to be more similar than not, which is rather disappointing considering there is not one approved way of "doing it right." However this large selection of CBT applications can rather confuse than help educators in choosing the "right one." Based on our theoretical and practical experience regarding CBT applications we address some of the questions educators might have in this regard and finally suggest some directions for further developments of CBT applications.

Study

The Past

In the early years of CBT, the approaches were rather technology-driven using simple technology and were often consistent, planned or by accident, with instructionism. The CBT applications did not provide much interaction and feedback was lacking to help students judge the effectiveness of their learning. Often, these systems were simply presenting a computerized version of a textbook, which often is much less useful than the actual book. Actually, this approach is still taken today by some publishers but can result in disastrous CBT.

The early systems were also lacking tools for managing the classroom. They did not include the students' records of grades and activities. They weren't portable but tied to a specific platform or networked. Single user systems available on floppy disks and later on CD-ROMs was the state of the art.

The Present

Many tools have been improved pedagogically (CBT Systems, 1999). They are interactive and help the students judge their own progress and how effective their learning is. However, since web based approaches are so fashionable now, we need to stress that these systems still tend to be inappropriate to support the learning process.

The current systems excel at helping manage the classroom in various ways. Many of the systems are networked and have many integrated functions. The systems record the dates when the tutorials were taken and also automatically grade multiple-choice tests and record the results. Thus, they help the instructors "peek over the students' shoulder" to see if they are doing the work and if the students are on track, e.g., by checking how much time the students spend on taking a tutorial and how good their test results are.

Unfortunately, these systems are only available for introductory courses that do not require too much flexibility. Also, they are often not comprehensive and stable enough to run easily with many students. Furthermore, the procedures for setup and the maintenance are quite complicated. So it might be difficult to find the faculty and staff to run such a system in a non-technical department. There are also no good tools to aid an instructor in creating educationally effective web sites. The systems are only minimally adaptive based on some pretest and they don't take much advantage of the possibilities of hypermedia. They don't allow for much exploration, i.e., they are quite linear forcing the students to go along with one of the few predetermined paths.

More and more systems are working in a simulated environment (in part to eliminate any incompatibilities between the lab networks and/or computers configurations and the requirements of the systems). Another reason for a strong trend in developing these type of systems is the increased chance of students to use it on their own personal computers without having to purchase the required software application.

There is also a strong movement toward developing integrated learning environment including training, evaluating, assessment and testing computer base application. These integrated learning environments can be Server-based or Web-based and tend to be pedagogically inadequate. Whereas the technology might have moved one step forward, the pedagogy of went two steps backwards (Mioduser, 1999).

The Future

So what would we like to see in the future based on our experience with these tools in the classroom and based on studying some related issues from a more research point of view (Hmelo, 1996, Hübscher, 1997, 1999).

We would like to see more adaptive tutorials based on preassessment and other feedback from the student with the goal of keeping the student in the zone of proximal development (Vygotsky, 1962). This would result in more individualized courses, more effective learning, and allow more self-directed path through the

learning material. If the student is kept in the zone of proximal development, it will also result in a more interesting and less frustrating learning experience for the student.

Support for content authoring that helps develop educationally effective presentations is desired. HTML editors surely don't do that.

Findings

In order to better evaluate the PinPoint CBT application (Kelly Services Co, 1999), before using it for our "Introductory to Personal Computer Applications" course (Marghitu, 1999) we ran a pilot test during one quarter. At the end of the quarter we used on line class evaluation involving students of the pilot test section and a regular section of the course as control group. These are the results of the evaluation.

Student Previous Computer Experience

All the students were non-engineering students with relatively little computer experience. The self-evaluation for the level of the students' previous computer experience was lower for the for the regular section (1.60) than for the PinPoint section (2.05). **Figure 1** shows the results of the students' self-evaluation, on a scale of 1 two five, for the level of previous computer experience (in percentage).

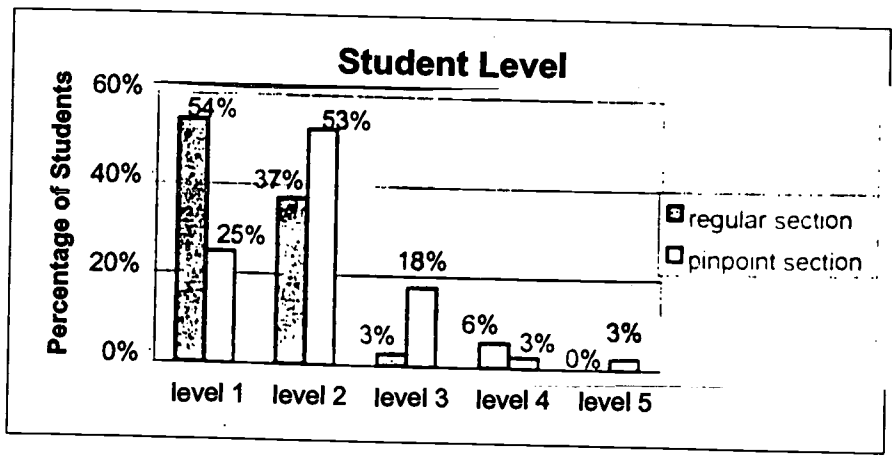

Figure 1: Chart representing the results of the students' self-evaluation for the level of previous computer experience

Student Evaluation

After the students had used the CBT system, we asked for their feedback. The questions we asked were:

- How would you rate your opinion of PinPoint?
- How would you rate your opinion of the COMP0100 WEB PAGE?
- How would you rate your opinion of COMP0100 TEXTBOOK?
- How would you rate your opinion of how much you have accomplished in COMP0100?

Figure 2 shows the results. Although there is a slight tendency in favor of the CBT, it is statistically not significant.

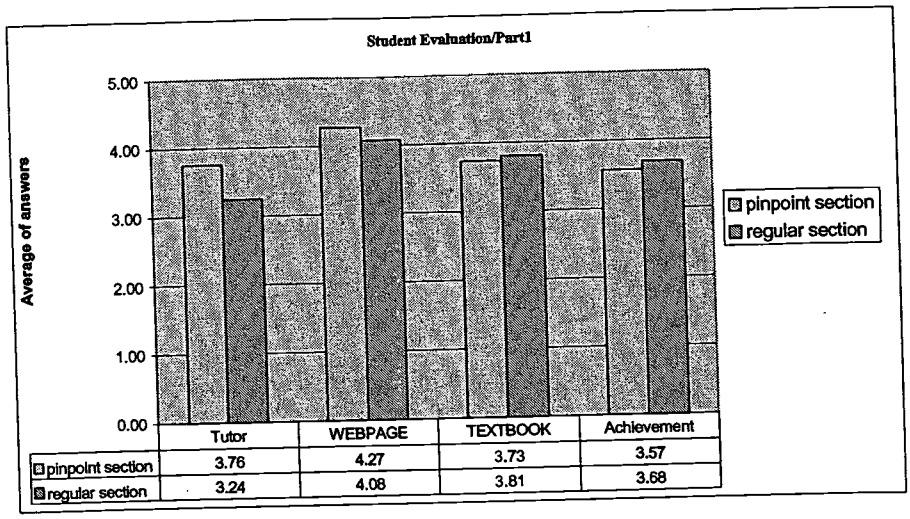

Figure 2: Chart representing the results of the Student Evaluation

We asked two more questions to find out how valuable they thought the PinPoint tool was with the following two questions. The results can be seen in Figure 3.

- Do you think you need more assistance from your instructor is required?
- Would you like to learn, in the near future, more about programming and/or using software applications?

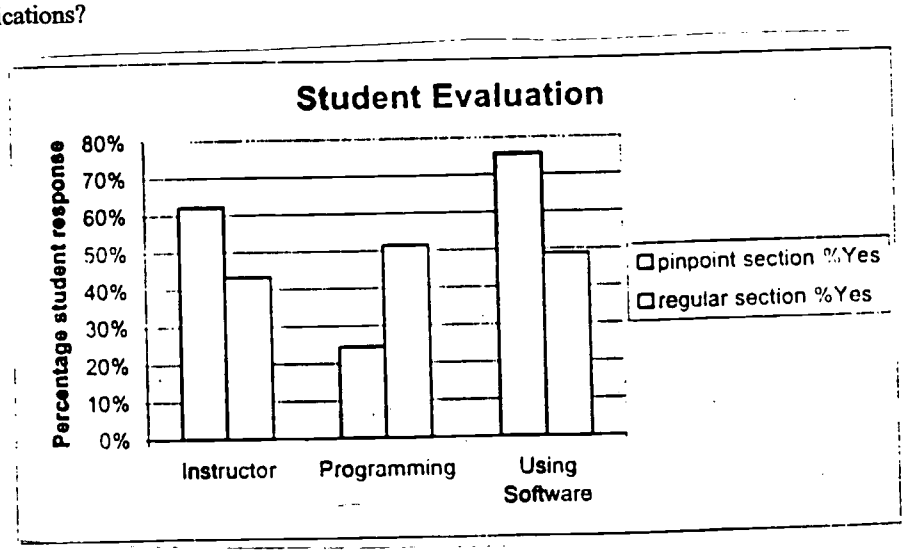

Figure 3 : Chart representing the results of the Student Evaluation

Instructor's evaluation

After using PinPoint in one section (out of a total of eighteen sections) we have started using PinPoint in all eighteen sections. Below are the conclusions reported by approximately ten instructors of these sections. We are planning to collect more data to find out whether the instructors' subjective reports match the actual performance of the students. The data reported is statistically not significant. The instructors are graduate

students of the Computer Science and Software Engineering department.

1. The interaction with PinPoint proved to contribute to successful learning (reading, typing, using the mouse, answering questions, and thinking). However, the use of too much video in a CBT product caused the students' brain to go into passive mode, thus reducing the effectiveness of the CBT :
   - the average grade of the students using a more dynamic & interactive upgraded CBT was higher
   - students using the upgraded CBT were more independent in doing the hands on projects so instructors could spend more time on pedagogical issues
2. CBT can be used effectively in small or large classes if they are customizable (or even minimally adaptive). They are good in creating richer learning environments and allowing students to learn at their own speed :
   - a customizable CBT helps instructors to create training modules that better match the student's background and goals, the textbooks (or concepts book) used, and the training modules and hands on projects selected
   - based on the results of a pre-test, a customizable CBT can help instructors create different learning paths for students helping students to be more effective. This includes
     - a self-paced multimedia approach for the students with an "above average" computer background
     - or a "CBT instructor-led classroom" approach for the students with a "below
3. CBT eases students' inhibitions about using and learning technology :
   - by helping students to become more independent in lab and also increasing their self-esteem a good CBT can also reduce students' inhibitions about using computers and their software applications
4. CBT can be very efficient learning tools in a classroom without taking away the vital importance of the instructor :
   - the results of the survey show clearly that students felt strongly about the necessity of instructor assistance
   - based on the detailed training reports provided by the management component of a competitive CBT, (see Figure 4) instructors can realize which subjects represent a real challenge

Timing results of Microsoft Word 97 Custom for Daniela Marghitu

Item No.	Item	Actual	Optimal	Correct	Did Show Me
4	Open a File	11	15	Yes	No
7	Replace Text	8	10	Yes	Yes (1)
8	Delete Text	4	5	No	No
9	Insert Text	10	10	Yes	No

Figure 4 : PinPoint detailed view of a training report

Conclusions

We have been somewhat critical about the past and present CBT systems. However, we feel that quite a

few systems are on the right track but are still lacking many elements directly related to pedagogy. For somewhat understandable reasons, these parts that are implemented are not difficult to do in principle, especially helping managing of classes and now also networking.

Nevertheless, an experiment in our 700-plus student classes to figure out the effectiveness of a CBT system (PinPoint) showed quite favorable results and we will keep continuing using CBT systems for our large introductory classes.

The results of the experiment suggest the following. Interaction with the system (reading, typing, using the mouse, and answering questions) contributed to successful learning. The use of too much video in a CBT product causes students to go into a passive hands-off mode reducing its effectiveness. CBT eases student's fear of using and learning with computer technology. This is apparently still a problem for many students—not all of them grow up with a computer under the pillow.

CBT can be a very efficient learning tool in classroom without taking away the vital importance of the instructor. We believe that CBT can be used even more effectively in small and large classrooms if they become more adaptive to the individual student and provide a richer learning environment allowing the students to learn in a more individualized fashion supporting the students needs.

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